

REMARKS

Claims 1 and 2 have been amended to require the Mn*S range to be 0.5 to 0.8, and the minimum amount of S present to be 0.35%. Support for these amendments exist, *inter alia*, at page 19, last line, and page 21, line 3.

Claims 1-20 are pending.

The Office Action rejected claims 1-4, 6-9, 13-15 and 17-20 under 35 U.S.C. § 103 as obvious over Japanese patent application JP 2003-253390 (“JP 390”), claims 1-5, 7-12 and 17-20 under 35 U.S.C. § 103 as obvious over Japanese patent application JP 2001-207240 (“JP 240”) and claim 16 under 35 U.S.C. § 103 as obvious over JP 240 in view of JP 390. In view of the following comments, Applicants respectfully request reconsideration and withdrawal of these rejections.

The present invention relates to specific steel products having improved properties such as, for example, improved machinability properties, improved surface roughness properties, improved deformation resistance properties and/or improved hardness properties. To achieve at least some of these improved properties, the invention steel of the present application requires, among other things, specific concentrations of Mn and S as well as specific Mn/S and Mn*S relationships, specific Of and S concentrations as well as specific Of/S relationships prior to casting, and/or specific dissolved nitrogen concentrations.

More specifically, the above claims have been amended to require the presence of at least 0.35% S, and a Mn*S value of 0.5-0.8.

The applied art, both of which are assigned to the assignee of the present application, neither teaches nor suggests the specified, inventive steel, nor does such applied art teach or

suggest how to modify the disclosures therein in such a way as to arrive at the invention steel or to arrive at steel having the improved properties associated with the invention steel.

Stated another way, one skilled in the art, following the disclosures of the applied art, would not be led to the invention steel, and in particular would not be led to the invention steel using the specific methods disclosed in the present application. The present application and invention steel herein reflects continued research and development conducted by the assignee of record which resulted in improved steel over its previous work as disclosed in JP 240 and JP 390. Nothing in the applied art would have led Applicants to the invention steel claimed in the present application.

For example, nearly all experimental examples in JP 240 and JP 390 contain S values lower than the required 0.35%. For at least this reason nearly all of the examples in the applied art cannot yield the claimed invention.

Examples D4 and D5 in Table 1 of JP 240 do not yield the claimed invention because, with respect to D4, the Mn*S value is too high (greater than 0.8) and, with respect to D5, the Mn value is too high (greater than 2%). These differences are significant. As demonstrated on page 50 of the present application, Steel 35/Comparative Example 43 which had an Mn concentration greater than 2%, an Of concentration of less than 30 ppm and an Of/S ratio of less than 0.005 prior to casting had sulfide inclusions of less than $2.8 * (\log d)$, poor surface roughness properties, poor deformation resistance characteristics and inferior machinability properties. Similarly, as demonstrated on pages 50-51 of the present application, Steel 36/Comparative Example 44 which had only 0.28% S and an Mn*S value less than 0.40 resulted in a product having poor surface roughness properties, poor deformation resistance

characteristics, inferior machinability and low dissolved nitrogen content. That is, products which did not include the specified requirements of the claimed invention were inferior.

JP 240 and JP 390 do not teach, suggest or recognize the result effective nature of Mn, S and/or Mn*S, and thus would not lead one of ordinary skill in the art to modify the products disclosed therein to yield the claimed invention. It is only through hindsight, using the present application as a guide, that the claimed invention and beneficial properties associated therewith can be obtained.

The difference between the invention steel and steel representative of the applied art is further reflected in the disclosure of the present application. For example, whereas the invention steel possesses improved properties as detailed throughout the present application,

- Steel 31/Comparative Example 39 had an Of concentration of less than 30 ppm and an Of/S ratio of less than 0.005 prior to casting which resulted in sulfide inclusions of less than $2.8 * (\log d)$, poor surface roughness properties and inferior machinability properties (See, page 49 of the present application).
- Steel 32/Comparative Example 40 and Steel 33/Comparative Example 41 had Mn/S ratios lower than 3.0 which resulted in cracked products during rolling, and these products could not be further evaluated (See, pages 49-50 of the present application).
- Steel 34/Comparative Example 42 had an Mn concentration of only 0.8% which resulted in a cracked product during rolling, and this product could not be further evaluated (See, page 50 of the present application).

- Steels 38-40/Comparative Examples 46-48 had Of concentrations and Of/S ratios which exceeded 100 ppm and 0.030, respectively, and resulted in products having low dissolved nitrogen content, poor surface roughness properties and inferior machinability. (See, page 51 of the present application).

All of the above information from the specification reflects the inescapable conclusion that the claimed, inventive steel having all of the required characteristics possesses improved properties as compared to steel which is similar but which does not include all of the required characteristics.

With respect to claim 1, at minimum, nothing in the applied art would lead one skilled in the art to the required Mn*S or Mn/S values. These values are significant (see, for example, Steel 32/Comparative Example 40 and Steel 33/Comparative Example 41 of the present application which are inferior and do not satisfy these values). Nothing in the applied art recognizes these values as being result effective, meaning that one of ordinary skill in the art would not be motivated to optimize these values. Nothing in the applied art would lead one of ordinary skill in the art to focus on Mn*S or Mn/S and, thus, would not lead to the present invention.

With respect to claim 2, at minimum, nothing in the applied art would lead one of ordinary skill in the art to the required deformation resistance properties, properties which reflect an improved steel product. (See, for example, Steel 35/Comparative Example 43 and Steel 36/Comparative Example 44 of the present application which are inferior and do not possess these properties). Nothing in the applied art recognizes how to obtain such properties in steel.

With respect to claims 3 and 7, at minimum, nothing in the applied art would lead one of ordinary skill in the art to the required dissolved nitrogen values. This is significant. (See, for example, Steel 36, 38-40/Comparative Example 44, 46-48 of the present application which are inferior and do not satisfy this requirement). Nothing in the applied art recognizes these dissolved nitrogen values as being result effective, meaning that one of ordinary skill in the art would not be motivated to optimize these values. Nothing in the applied art would lead one of ordinary skill in the art to this inventive steel product.

With respect to claims 6 and 13-16, at minimum, nothing in the applied art would lead one of ordinary skill in the art to the required Of concentrations and Of/S ratios prior to casting, which are significant characteristics of the present invention. (See, for example, Steel 31, 35, 38-40/Comparative Examples 39, 43, 46-48 of the present application). Nothing in the applied art recognizes these values prior to casting as being result effective, meaning that one of ordinary skill in the art would not be motivated to optimize these values at that particular time in the production process. Nothing in the applied art would lead one of ordinary skill in the art to this inventive steel product by the required process.

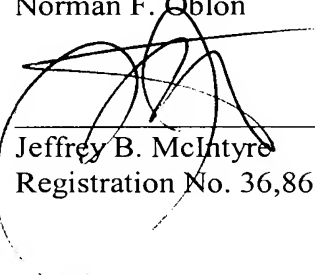
In sum, the claimed invention requires many specific aspects which result in steel having improved properties in many areas. The specification is replete with data and other information reflecting the novel, unobvious characteristics of the claimed steel products. Nothing in the broad, generalized disclosures of the applied art would lead one of ordinary skill in the art to focus on the specific characteristics of the claimed steel of the present invention with the reasonable expectation that such steel would have improved properties as detailed above. Clearly, the inventive steel is neither taught nor suggested by the applied art.

In view of the above, Applicants respectfully request reconsideration and withdrawal of the rejections under 35 U.S.C § 103.

Applicants believe that the present application is in condition for allowance. Prompt and favorable consideration is earnestly solicited.

Respectfully submitted,

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